

**What is claimed is:**

1           1.    A method for evaluating overlay registration,  
2    comprising:  
3           forming a first pattern on a wafer by  
4           photolithography with a first reticle having a  
5           first reticle pattern thereon;  
6           forming a photoresist layer on the wafer;  
7           patterning the photoresist layer to form a second  
8           pattern by photolithography with a second  
9           reticle having a second reticle pattern  
10          thereon;  
11          measuring deviations between the first and second  
12          patterns on the wafer along X, Y, or X and Y  
13          axes;  
14          calibrating a scaling value and an overlay offset of  
15          the deviations to obtain an overlay  
16          registration value; and  
17          determining whether the registration value is out of  
18          specification.

1           2.    The method as claimed in claim 1, wherein the  
2    first and second reticle patterns are patterns for active  
3    regions, gate layers, deep trenches for capacitors,  
4    contact openings, bit line openings or a layer of  
5    interconnection.

1           3.    The method as claimed in claim 1, wherein the  
2    deviations of the wafer are measured with a critical  
3    dimension scanning electron microscope (CD-SEM) from the  
4    top thereof.

1           4. The method as claimed in claim 1, wherein the  
2 first/second pattern is formed by transferring the  
3 first/second reticle pattern step-and-repeatedly onto the  
4 wafer/photoresist layer A times, resulting in the  
5 first/second pattern consisting of A transferred  
6 patterns.

1           5. The method as claimed in claim 4, wherein  
2 deviations between the first and second patterns are  
3 measured by selecting B transferred patterns from the A  
4 transferred patterns for measurement with  $B \leq A$ .

1           6. The method as claimed in claim 5, wherein the  
2 first/second pattern consisting of A transferred patterns  
3 is rectangular and the B transferred patterns are  
4 selected from transferred patterns on the four corners  
5 and center of the first/second pattern.

1           7. The method as claimed in claim 5, wherein the  
2 deviations along X or Y axis are calculated by the steps  
3 of:

4           selecting a plurality of points from each of the B  
5           transferred patterns along X or Y axis; and  
6           measuring the deviations between the first and  
7           second patterns on the selective points.

1           8. The method as claimed in claim 7, wherein the  
2 points selected along X-axis are selected from N points  
3 in M rows along X axis of each selected transferred  
4 pattern, and the points selected along Y axis are

5 selected from Q points in P columns along Y axis of each  
6 selected transferred pattern.

1 9. The method as claimed in claim 8, wherein the  
2 scaling value is a slope (S) obtained by linear  
3 regression of the deviations of the N point in each row  
4 along X axis, or a slope (S) obtained by linear  
5 regression of the deviations of the Q point on each  
6 column along Y axis.

1 10. The method as claimed in claim 9, wherein the  
2 overlay offset of each selected row or column is an  
3 average value of the deviations with scaling calibration.

1 11. The method as claimed in claim 9, wherein  
2 determination of whether the registration value is out of  
3 specification is calculated by a statistical method.

1 12. The method for evaluating overlay registration,  
2 comprising:

3 forming a first pattern on a wafer by  
4 photolithography with a first reticle having a  
5 first reticle pattern thereon;

6 forming an anti-reflection layer on the wafer

7 forming a photoresist layer on the anti-reflection  
8 layer;

9 patterning the photoresist layer and the anti-  
10 reflection layer to form a second pattern by  
11 photolithography with a second reticle having a  
12 second reticle pattern thereon;

13 removal of the anti-reflection layer from the second  
14 pattern;

15           measuring deviation between the first and second  
16           patterns on the wafer along X, Y or X and Y  
17           axes;  
18           calibrating a scaling value and an overlay offset of  
19           the deviations to obtain an overlay  
20           registration value; and  
21           determining whether the registration value is out of  
22           specification.

1           13. The method as claimed in claim 12, wherein the  
2           first and second reticle patterns are patterns of active  
3           regions, gate layers, deep trenches for capacitors,  
4           contact openings, bit line openings or a layer of  
5           interconnection.

1           14. The method as claimed in claim 13, wherein the  
2           deviations of the wafer are measured with a critical  
3           dimension scanning electron microscope (CD-SEM) from the  
4           top thereof.

1           15. The method as claimed in claim 12, wherein the  
2           first/second pattern is formed by transferring the  
3           first/second reticle pattern step-and-repeatedly onto the  
4           wafer/photoresist layer A times, resulting in the  
5           first/second pattern consisting of A transferred  
6           patterns.

1           16. The method as claimed in claim 15, wherein the  
2           deviations between the first and second patterns are  
3           measured by selecting B transferred patterns from the A  
4           transferred patterns for measurement with  $B \leq A$ .

1           17. The method as claimed in claim 16, wherein the  
2 first/second pattern consisting of the A transferred  
3 patterns is rectangular and the B transferred patterns  
4 are selected from transferred patterns on the four  
5 corners and center of the first/second pattern.

1           18. The method as claimed in claim 16, wherein the  
2 deviations along X or Y axis is calculated by the steps  
3 of:

4           selecting a plurality of points from each of the B  
5           transferred patterns along X- or Y-axis; and  
6           measuring the deviations between the first and  
7           second patterns on the selective points.

1           19. The method as claimed in claim 18, wherein the  
2 points selected along X-axis are selected from N points  
3 in M rows along X-axis of each selected transferred  
4 pattern, and the points along Y-axis from Q points in P  
5 columns along Y-axis of each selected transferred  
6 pattern.

1           20. The method as claimed in claim 19, wherein the  
2 scaling value is a slope (S) obtained by linear  
3 regression of the deviations of the N point on each row  
4 along X-axis, or a slope (S) obtained by linear  
5 regression of the deviations of the Q point on each  
6 column along Y axis.

1           21. The method as claimed in claim 20, wherein the  
2 overlay offset of each selected row or column is an  
3 average value of the deviations with scaling calibration.

1           22. The method as claimed in claim 12, wherein  
2           determination of whether the registration value is out of  
3           specification is calculated by a statistical method.

1           23. A method for fabricating a wafer sample for  
2           inspection of a critical dimension scanning electron  
3           microscope (CD-SEM), comprising the steps of:

4           forming a first pattern on a wafer by a first  
5           reticle;

6           forming a photoresist layer on the wafer; and  
7           patterning the photoresist layer to form a second  
8           pattern with a second reticle, thereby forming  
9           a wafer sample for CD-SEM inspection.

1           24. A method for fabricating a wafer sample for  
2           inspection by a critical dimension scanning electron  
3           microscope (CD-SEM), comprising the steps of:

4           forming a first pattern on a wafer by a first  
5           reticle;

6           forming a photoresist layer on the wafer;  
7           forming an anti-reflection layer on the photoresist  
8           layer;

9           patterning the anti-reflection layer and the  
10           photoresist layer to form a second pattern with  
11           a second reticle;

12           removal of the anti-reflection layer from the second  
13           pattern, thereby forming a wafer sample for CD-  
14           SEM inspection.